

Icy Regolith Excavation and Volatile Capture under Vacuum Conditions (ICEX)

Completed Technology Project (2013 - 2014)



Project Introduction

This project will provide NASA with a testbed for demonstrating mining technologies involving the excavation of icy planetary regolith and the extraction of sublimated solid volatiles from icy regolith collected under environmental conditions similar to those found on asteroids, Mars, and the Moon.

NASA Kennedy Space Center is developing a testbed for producing large volume mixtures of ice and regolith under low pressure inside a laboratory vacuum chamber. This will allow those technologies that are being developed to excavate and utilize icy planetary regolith, to be tested and evaluated during actual operation under simulated surface conditions such as those found on asteroids, Mars, and the Moon.

The results of testing under relevant environmental conditions will be used to validate existing or future physical models that predict excavation forces related to mining planetary regolith, and to determine the amount of energy required to excavate the regolith and to sublimate solid volatiles contained in icy regolith.

Anticipated Benefits

Current and future NASA missions that include planned surface activities involving the interaction of robotic hardware with planetary regolith will benefit from the NASA KSC regolith testbed on earth, which will be able to provide regolith simulants that can be tested under similar environmental conditions in order to validate the actual responses or to anticipate how the hardware will interact with actual planetary regolith.

The commercial space mining industry will include regolith excavation activities involving the interaction of robotic hardware with planetary regolith that will benefit from the NASA KSC regolith testbed, which will be able to provide regolith simulants that can be tested under various environmental conditions in order to anticipate how the particular hardware will interact with planetary regolith.

Government agencies involved with civil engineering activities will benefit from the NASA KSC regolith testbed, which will be able to provide an environment in which soils can be tested under various environmental conditions in order to anticipate how particular excavation hardware will interact with the soil in specific locations on earth.



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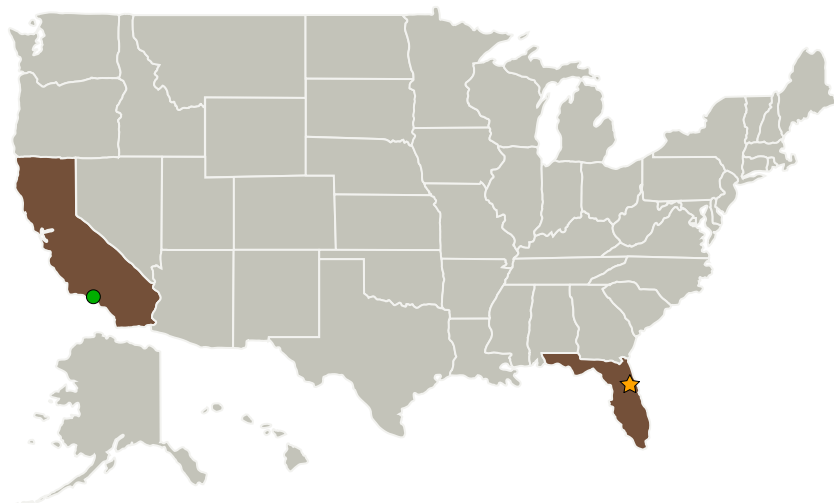
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California
UCF Center for Lunar and Asteroid Surface Science(CLASS)	Supporting Organization	Academia	Orlando, Florida
University of Central Florida(UCF)	Supporting Organization	Academia	Orlando, Florida

Primary U.S. Work Locations

California	Florida
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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Kennedy Space Center (KSC)

Responsible Program:

Center Innovation Fund: KSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Barbara L Brown

Project Manager:

Nancy P Zeitlin

Principal Investigator:

James G Mantovani

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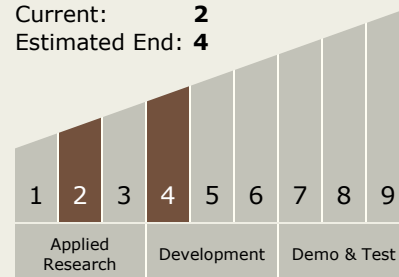
Stories

NIAC Project: In Space Propulsion Engine Architecture Based on Sublimation of Planetary Resources

(<https://techport.nasa.gov/file/1095>)

Technology Maturity (TRL)

Start: 2
Current: 2
Estimated End: 4



Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - TX07.1 In-Situ Resource Utilization
 - TX07.1.2 Resource Acquisition, Isolation, and Preparation